

Claims

- [c1] A communication device for transmitting signals to a receiver comprising:
at least one optical light source adapted to generate light simultaneously at multiple wavelengths;
at least one detector adapted to detect light at multiple wavelengths;
a target fixed in line-of-sight relation to said optical light source and in line-of-sight relation to said detector;
a modulating device connected in modulating relation to said optical light source;
said modulating device adapted to modulate each of said multiple wavelengths so that multiple messages are transmitted simultaneously;
said at least one detector adapted to demodulate light scattered by said target;
said at least one detector including an optical bandpass filter adapted to pass preselected wavelengths of light and reject wavelengths of light outside of said preselected wavelengths;
whereby multiple messages are simultaneously transmitted along multiple wavelengths; and
whereby said multiple messages are individually detected by said detector.
- [c2] The communication device of claim 1, wherein the light source is selected from the group consisting of a laser light source and a light-emitting diode.
- [c3] The communication device of claim 1, further comprising:
an enclosure that houses said optical light source and said detector;

said enclosure including at least one wall member;

said at least one wall member being said target.

[c4] The communication device of claim 1, further comprising:

an enclosure that houses said optical light source, said detector, and said barrier;

said enclosure including at least one ceiling member;

said at least one ceiling member being said target.

[c5] The communication device of claim 1, further comprising:

an enclosure that houses said optical light source, said detector, and said barrier;

said enclosure including at least one floor member;

said at least one floor member being said target.

[c6] A communication device adapted to reflect signals from a light reflecting target, comprising:

a first data communication device adapted to transmit multiple sets of data through multiple wavelengths, there being as many wavelengths as there are sets of data;

a laser source modulated by said first data communication device;

a transmitter telescope adapted to aim modulated light of said multiple wavelengths from said laser source to a light-reflecting target;

a second data communication device adapted to receive multiple sets of data carried by said multiple wavelengths;

an optical detector connected in driving relation to said second data communication device, said optical detector adapted to generate

electrical signals corresponding to detected optical signals;
a receiving telescope adapted to collect modulated light reflected from said light-reflecting target at said multiple wavelengths and to deliver said modulated light to said optical detector;
an optical bandpass filter connected between said receiving telescope and said optical detector;
a barrier means adapted to be positioned between said first and second data communication devices, said barrier means preventing line-of-sight communication between said first and second data communication devices;
whereby said transmitter telescope causes modulated light at multiple wavelengths to reflect from said light-reflecting target;
whereby said receiver telescope causes reflected light at said multiple wavelengths to focus on said optical detector;
whereby said second data communication device receives electrical signals from said first data communication device; and
whereby said optical bandpass filter passes each of said multiple wavelengths to said optical detector so that multiple messages are sent simultaneously from said first data communications device to said second data communications device.

[c7] The communication device of claim 6, wherein said light-reflecting target is a ceiling of a structure adapted to house said first and second data communication devices.

[c8] The communication device of claim 6, wherein said light-reflecting target is a wall of a structure adapted to house said first and second data

communication devices.

[c9] The communication device of claim 6, wherein said light-reflecting target is a floor of a structure adapted to house said first and second data communication devices.

[c10] The communication device of claim 6, wherein said light-reflecting target is a tree external to a structure adapted to house said first and second data communication devices.

[c11] The communication device of claim 6, wherein said light-reflecting target is a second structure external to a first structure adapted to house said first and second data communication devices.

[c12] A communication device adapted to be disposed in an enclosure having walls and a ceiling, comprising:

a first data communication device adapted to transmit data;

a laser source modulated by said first data communication device;

said laser source adapted to generate light at multiple wavelengths;

a first optical lens means having a $\pi/2$ steradians field of view, said

first optical lens means being positioned in light dispersing relation to said laser source;

a second data communication device adapted to receive data;

an optical detector connected in driving relation to said second data communication device, said optical detector adapted to generate

electrical signals corresponding to detected optical signals;

said optical detector adapted to detect light at multiple wavelengths;

a second optical lens means having a $\pi/2$ steradians field of view, said

second optical lens means being positioned in light focusing relation to said optical detector;

a barrier means adapted to be positioned in said enclosure between said first and second data communication devices, said barrier means preventing line-of-sight communication between said first and second data communication devices;

an optical bandpass filter connected between said second optical lens means and said optical detector;

whereby said first optical lens means causes modulated light at multiple wavelengths to reflect from said ceiling and walls of said enclosure;

whereby said second optical lens means causes reflected light at said multiple wavelengths to focus on said optical detector; and

whereby said second data communication device receives electrical signals at said multiple wavelengths from said first data communication device.

[c13] The communication device of claim 12, wherein said first optical lens means is a hemispherical short focus lens.

[c14] The communication device of claim 12, wherein said first optical lens means is provided in the form of transmitter optics.

[c15] The communication device of claim 12, further comprising electrical signal conditioning means electrically connected between said first data communication device and said laser source.

[c16] The communication device of claim 12, wherein said second optical lens means is a hemispherical short focus lens.

[c17] The communication device of claim 12, further comprising electrical signal conditioning means electrically connected between said optical detector and said second data communication device.

[c18] A communication device adapted to reflect signals from remote targets positioned in an environment external to the environment of the communication device, comprising:

a first data communication device adapted to transmit data;

a laser source modulated by said first data communication device;

a transmitter telescope adapted to aim modulated light from said laser source to a remote target positioned in an environment external to the environment of said communication device;

a second data communication device adapted to receive data;

an optical detector connected in driving relation to said second data communication device, said optical detector adapted to generate electrical signals corresponding to detected optical signals;

a receiving telescope adapted to collect modulated light reflected from said remote target and to deliver said modulated light to said optical detector;

a barrier means adapted to be positioned between said first and second data communication devices, said barrier means preventing line-of-sight communication between said first and second data communication devices;

whereby said transmitter telescope causes modulated light to reflect from said remote target;

whereby said receiving telescope causes reflected light to focus on said

optical detector; and

whereby said second data communication device receives electrical signals from said first data communication device.

[c19] The communication device of claim 18, further comprising an optical bandpass filter connected between said receiving telescope and said optical detector.

[c20] A LIDAR communication system, comprising:

- a laser adapted to generate a LIDAR beam;
- a transmitting device for modulating said laser;
- a transmit telescope adapted to aim said LIDAR beam at a remote target;
- a receiver telescope adapted to collect said LIDAR beam after said LIDAR beam has reflected from said remote target;
- an optical detector means in communication with said receiver telescope, said optical detector means adapted to generate electrical signals upon receiving reflected light from said receiver telescope;
- a data receiving device adapted to receive electrical signals from said optical detector;

whereby said data receiving device receives data from said data transmitting device even when said data receiving device is positioned in a location distant from said data transmitting device and when at least one obstacle prevents line-of-sight communication between said data transmitting device and said data receiving device.

[c21] The LIDAR communication system of claim 20, further comprising:

an electrical signal conditioner disposed in electrical communication between said data transmitting device and said laser, said electrical signal conditioner adapted to condition signals from said data transmitting device.

- [c22] The LIDAR communication system of claim 20, further comprising:
an electrical signal conditioner disposed in electrical communication between said optical detector and said data receiving device, said electrical signal conditioner adapted to condition electrical signals from said optical detector.
- [c23] The communication device of claim 20, further comprising an optical bandpass filter between said receiver telescope and said optical detector.
- [c24] The communication device of claim 18, further comprising multiple optical wavelengths for communication of different communication signals simultaneously when the same external remote target spatial area is used as a common target for multiple communication devices.
- [c25] The communication device of claim 18, further comprising multiple optical wavelengths for communication of different communication signals simultaneously when the same external remote target spatial area is used as a common target for LIDAR communication devices.
- [c26] The communication device of claim 20, further comprising multiple optical wavelengths for communication of different communication signals simultaneously when the same external remote target spatial

a is used as a common target for multiple communication devices.

- [c27] The communication device of claim 20, further comprising multiple optical wavelengths for communication of different communication signals simultaneously when the same external remote target spatial area is used as a common target for LIDAR communication devices.
- [c28] The communication device of claim 18, wherein said device is adapted to aim said modulated light from said laser source at different multiple external remote targets and target spatial regions to separate spatially different communication optical signals from one another.
- [c29] The communication device of claim 20, wherein said device is adapted to aim said modulated light from said laser source at different multiple external remote targets and target spatial regions to separate spatially different communication optical signals from one another.
- [c30] The communication device of claim 18, further comprising an optical communication signal transmitted to a remote external target wherein the backscattered optical signal is detected simultaneously by multiple telescope receivers positioned at different locations.
- [c31] The communication device of claim 18, further comprising a common optical communication signal transmitted to a remote external target wherein the backscattered optical signal is detected simultaneously by multiple telescope receivers positioned at different locations.
- [c32] The communication device of claim 20, further comprising an optical communication signal transmitted to a remote external target wherein the

backscattered optical signal is detected simultaneously by multiple telescope receivers positioned at different locations.

[c33] The communication device of claim 20, further comprising a common optical communication signal transmitted to a remote external target wherein the backscattered optical signal is detected simultaneously by multiple telescope receivers positioned at different locations.